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Abstract

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Based on Complexity Theory, nine categories of decision making styles are described: The low unidimensional decision maker, the normal unidimensional decision maker, the general differentiator, the closed hierarchical differentiator, the excessive differentiator, the low level integrator, the high level integrator, the closed hierarchical integrator, and the non-closing integrator. Ten different decision measures are defined and formulas for their calculation are presented: Decision categories, spread across decision categories, number of decisions, number of integrations, Quality of Integrated Strategies (QIS), number of respondent decisions, characteristic response and response speed to information, quality (if immediate response is required), quality (if novel strategy is required) and quality (if learned pre-established strategy is required). For each of the decision making styles, predictions are made about performance on each of the ten decision measures.

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I. Decision Making in Complex Tasks

Siegfried Streufert and Susan C. Streufert

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Stress and the Measurement of Task Performance:

I. Decision Making in Complex Tasks

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Most research on the effects of stressors on task performance has tended to focus on the effects of some single stressor variable. For example, research has been specifically concerned with the effects of noise, the effects of crowding, or the effects of information load, and so forth. In addition, researchers have most often measured the effects of those stressors on a single specific task variable. In the majority of cases, the tasks have been simple in nature but quite different in characteristic. Measures of performance have differed as well. As a result, comparisons among research efforts are difficult to make. For example, the data of Reim, Glass and Singer (1971) relating selected noise levels to proof-reading performance, the research of Freedman, Klevansky and Ehrlich (1971) on crossing out letters or forming anagrams in a crowded setting, and the work of Streufert (1970) and associates concerned with information load effects on decision making use no common denominators. Even where researchers have employed several dependent measures, they have rarely aided a more general understanding of stressor effects. To return to the research cited above, Freedman et al. measured performance in crossing out words, forming words, and anagram tasks. It remains unclear whether or why similar or different performance levels should be expected for the task measures (except for assumptions of greater difficulty levels). Streufert and associates measured response rate, respondent decision making, integrated decision making, and general unintegrated decision making. While the latter three measures may be summed into the first, the measures are best described as widely differing in the types of performance they assess. They contribute (by themselves) little to a complementary measurement of similar performance characteristics, i.e., to cross validation of performance measurement. Finally, the measures employed by the various researchers are not very useful in comparing performance across tasks. The number of crossed-out words is hardly a useful measure in a complex decision-making task, and the number of integrations, as used previously, is difficult to adapt to the simple tasks employed, for example, by Reim *et al*. and Freedman *et al*.

Previous research efforts on stressor effects have certainly added to our knowledge about specific relationships among given stressors and given performance outcomes, yet they have not been particularly useful for the discovery of more general (cross-task and cross-situational) relationships that might lead to an overall theory of stressor effects. Clearly, comparisons between stressor effects on different kinds of tasks and different task settings are possible only if a range of conceptually or directly equivalent measures can be utilized across tasks environments. Further, control measures are needed to check on the equivalence of stress in different tasks and different settings (e.g., physiological arousal monitoring via simultaneous systolic blood pressure, diastolic blood pressure, and heart rate measurement). The purpose of the present paper is to define a number of performance measures that may be utilized in a complex task setting.

Potential utilization of these measures in simpler tasks or task settings will be discussed in terms of their equivalence and/or in terms of their conceptual similarity to parallel measurement in complex tasks. A more detailed discussion of task performance measurement in simple tasks will follow in a subsequent report.

Task Design

As suggested above, tasks can be simple or complex. For the present purpose, we will consider a simple task to be a problem-solving effort (i.e., a correct solution to a problem is potentially available) and we shall consider a complex task to be a decision-making situation (where several solutions are possible and the final outcome of any one decision cannot be ascertained before or immediately following the decision). A similar distinction (although not quite equivalent) can be made in terms of the response repertoires of the decision maker(s). Responding in a simple task can depend on a learned "correct" response to a stimulus presentation, whether this response comes about through multidimensional hierarchical branching or through a simple S - R chain. Responding in a complex task (if appropriate to the task demands) may (at times) be either the same as that for the simple task or may require manipulation of information on several dimensions, interrelating the dimensions with each other and arriving at one or more competing response options which may again be considered in comparison to each other in terms of some overall conceptualization, goal, or strategy.

Research on the present contract is guided by the need to compare simple with complex tasks and to determine stressor effects across task and situational variation. For the simple task used in this research effort, a visual-motor coordination video game has been selected. The game permits precise control of stressor levels on two dimensions (speed and difficulty level). The complex task currently under development is a multidimensional, complex, experimental simulation procedure, controlling information input to participants and allowing the participants relative freedom of decision choice (within resource limits). Both the simple and the complex task permit different kinds of general, respondent, and strategic behaviors. While general and respondent measurement across these diverse tasks can be completely or nearly identical, measurement of strategic behavior must utilize different, but functionally equivalent, measurement techniques.

Complexity Theory and Task Performance

Previous research on the effects of load, noxity, eucity, relevance, and other information stressors on task performance has most often been based on the propositions of the early complexity theory advanced by Schroder, Driver and Streufert (1967). Examples of this approach are the research efforts of Cummings, O'Connell and Huber (1978); Driver and Mock (1974); Higbee (1971); Karlins and Lamm (1967); Streufert and Schroder (1965), Suedfeld and Vernon (1966), and others. The Schroder et al. theory proposed individual (and homogeneous group) differences in dimensional stylistics of perceptual, decision making, and other behavioral characteristics, varying from "unidimensional" to "multidimensional." Attention to data collected after the publication of the Schroder et al. volume, and a careful study of subsequent advances of complexity theory (e.g., Scott, Osgood and Peterson, 1979; Streufert, 1978; Streufert and Streufert, 1978) reveal that such an "overall" approach is, at best, a simplification. Assumptions that greater complexity and increased "quality of performance" vary directly with an increasing number of dimensions in the cognitive style of a person (or group) are not justified. Insights following the research data generated by efforts based on Schroder et al. (1967) have resulted in theoretical positions (Streufert, 1978; Streufert and Streufert, 1978) requiring the researcher to consider several additional cognitive characteristics. As a minimum, the following cognitive characteristics must be of concern:

1. The number and independence of (task relevant cognitive) dimensions involved,
2. The openness/closedness to information,
3. The degree of differentiation,
4. The degree of integration, and
5. The degree to which differentiation and integration activities (but primarily the latter) are flexible vs. hierarchical.

There are yet other characteristics that are potentially important, e.g., the domain within which dimensionality is relevant (c.f., Scott et al, 1979). To limit the discussion presented in this paper, these additional (and for the present purposes, less important) characteristics will not be considered here. The interested reader is referred to Streufert and Streufert, 1978.

In contrast to some other cognitive theories of (decision making) performance (e.g., Jaques, 1976, 1978), the five characteristics above are not viewed as distinct stylistics that can be described as discrete or as sole representations of an individual's style. They are seen as stylistic responses to environmental information and to task performance demands which are neither orthogonal to each other nor discrete from each other. The styles may (slowly) develop out of each other (in a somewhat restricted sense) or they may alternate (up to the level of a person's capacity) with each other in response to task demands (again with limitations). For example, developmental progression toward greater integration can proceed from a low unidimensional through a normal unidimensional information processing style and on to general differentiation, to low level integration and, finally, high level integration. However, a person may branch off at the differentiation level (if he or she progresses beyond that point at all) toward either a hierarchical and closed differentiative style or toward an open, but excessive, differentiation style. Both of the latter would exclude the possibility of flexible integration, even at relatively low levels. A branching figure might explain this description:

Insert Figure 1 About Here

Styles of Decision Making

Developmental progression through various cognitive characteristics would, nonetheless, result in generally dominant styles of decision making performance at any one point in time, modified, of course, by potential environmental and/or task demands. We can then (since styles change very slowly or may become permanently established at certain levels) describe persons by their "typically" utilized styles (all other factors being constant). The categories listed below represent such primary decision making styles and their expression in response to optimal (c.f., Streufert and Streufert, 1978) task demands:

Category 1: The low unidimensional decision maker. On the average, this person uses a categorical (e.g., good vs. bad) judgment in response to a stimulus. Degrees of judgment (e.g., A is better than B, but not as good

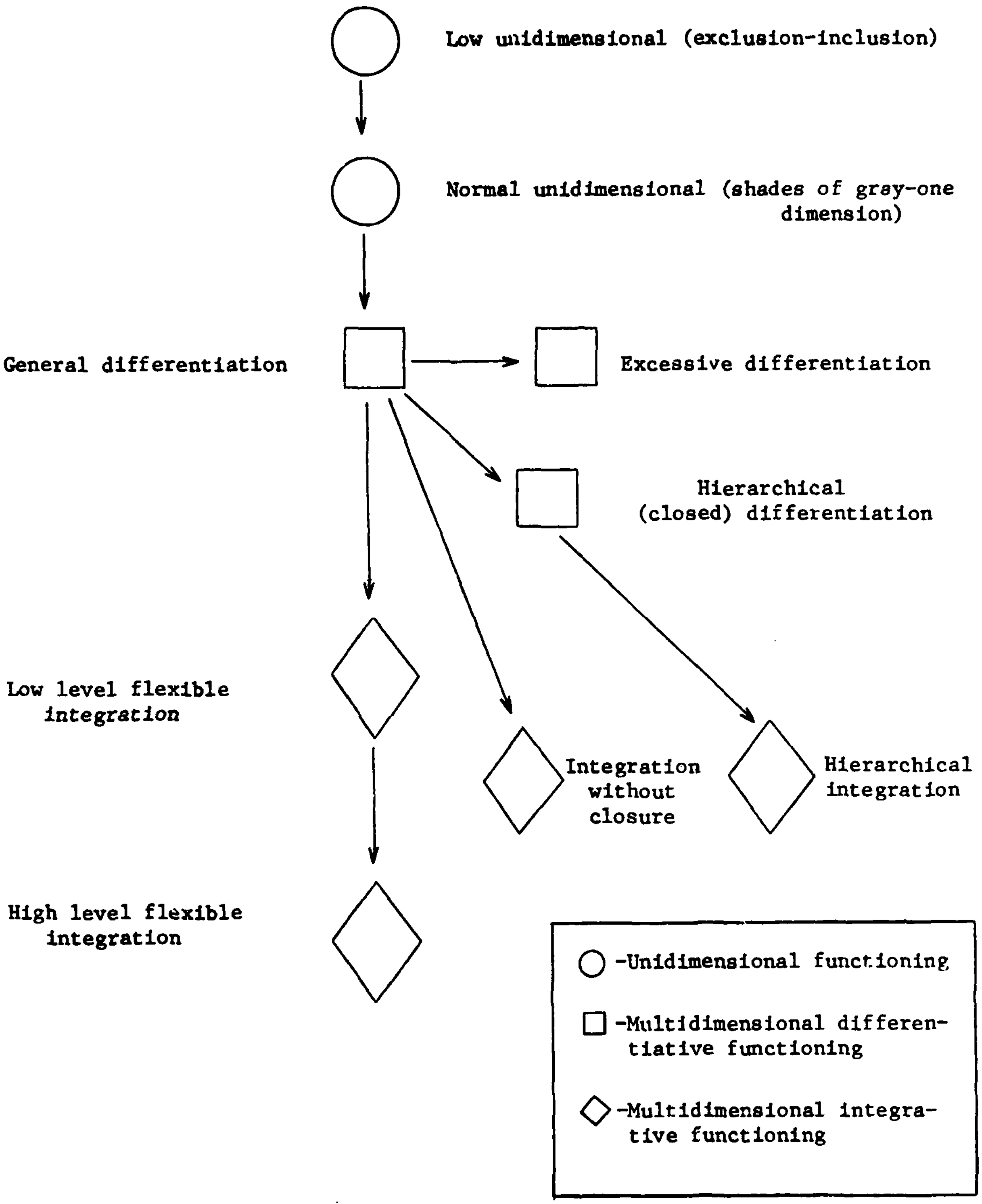


Figure 1. Progression of cognitive style in perceptual, decision making, and other efforts.

as C) are rarely or never available. The dimension utilized is usually the same with regard to nearly all stimulus situations, but could occasionally vary with the domain employed.

Category 2: The normal unidimensional decision maker. This person utilizes a single dimension in response to any particular stimulus, but can easily consider "shades of gray" (i.e., discrimination of points along one dimension). If different dimensions are employed for different stimulus situations, the person is probably not aware that he or she is utilizing different dimensional judgments (e.g., utility in a business stimulus setting, good vs. bad in a religious setting, etc.).

Category 3: The general differentiator. This person does (with awareness) employ two or more dimensions in response to a single stimulus (or stimulus set), but either views these *dimensions as non-interrelated* (e.g., a person is like this when A happens and like that when B happens), or such a differentiator would pick and choose one of the dimensional outcomes for his or her actions. In other words, integration does not take place except in extremely limited situations.

Category 4: The closed - hierarchical - differentiator. We are here combining the effect of closedness with the process of hierarchical information processing (the absence of processing flexibility). While the processes involved are oblique, they are not necessarily so widely separated in the decision making process to justify independent categories. Hierarchical processing of information from input to output (perception to decision making) suggests that a set of relationships has been learned, or is otherwise given, that determines the outcome in advance. For example, the process may say "if event A occurs, it may be responded to by either X or Y. Which of the two is appropriate depends on the simultaneous occurence or nonoccurence of B."

Closedness indicates that this pre-learned process is not, in-and-of-itself, subject to modification. Relearning of a new process would have to follow the same pattern of learning that was established when the initial acquisition took place, or would, at least, require major (probably negative reinforcement) impact experiences.

The closed hierarchical differentiator, then, employs two or more dimensions in response to a single stimulus, dimensions that are predetermined and that have predetermined characteristics or rules governing which dimensions are selected.

Category 5: The excessive differentiator. Differentiation into finer and finer sub-dimensions can take place nearly <u>ad infinitum</u>. Some decision makers tend to generate an inordinate number of alternative possibilities of responding, consequently responding very late or not responding at all. Integration does not take place at all for such persons.

Category 6: The low level integrator. Developing beyond the general differentiator, the low level integrator is able to close (for decision making) and reopen (for reconsideration or for additional decision processes). Such a person will differentiate incoming information i.e., view a stimulus on more than one dimension, as the differentiator did, but will see no need to make a decision choice based on only one of these dimensions. Rather, some superordinate concept (dimension, etc.) may be used to <u>combine</u> outcomes from the two separate dimensional judgments into a single decision output (or several related outputs).

Category 7: The high level integrator. As in category 6, flexibility to be open, to close, and to re-open is again given. The difference here is the number and interactive characteristics of the superordinate concepts that are used to relate the different "readings" from the various dimensions on which a stimulus is perceived. (Note that one of those superordinate categories may well be a time perceived consequence in the sense considered by Jaques, 1978).

Category 8: The closed hierarchical integrator. Again, we are combining closedness with hierarchical functioning (for the reasons listed earlier). Here, the decision maker has learned (or has otherwise determined) specific complex conditional statements in response to a specific relationship between stimuli and decision outputs. He is using an (often weighted) complex branching technique to arrive at a fixed decision. He is not likely to re-open to reconsider his decisions or to alter his style in the face of input that does not quite fit preestablished patterns. Most likely such an input would be distorted to fit. Changes in the dimensional location of certain stimuli are likely to be rejected, particularly if they require a modification of several relationships in the hierarchical structure of conceptual relationships.

Category 9. The non-closing integrator. This person is simultaneously quite capable, yet decisively ineffective. The non-closing integrator is usually a flexible integrator with high level integrative capacity (c.f., Category 7), but without the ability to close temporarily for decision making. This is a person who generates an inordinate number of complex interpretations and decision potentials, taking a large number of concerns into account. Because he or she comes to so many different conclusions, none of which seems quite good enough (because there are still so many other things to consider and integrate), decisions will rarely be made. If they are made, they tend to span over long time periods (on the average).

Measurement Based on Stylistic Categories

The different styles of decision making described in the nine categories above would, of course, produce different decisions, i.e., considerable discrepancies in task performance. Certainly, such differences cannot be discovered (except via the acceptability or non-acceptability of the final performance outcome) unless appropriate measures are developed. In their earlier work on complex decision making simulations, Castore and Streufert (1967) used decision matrices as described by Streufert, Clardy, Driver, Karlins, Schroder and Suedfeld (1965) as raw data to employ factor analytic procedures of Horst (1965) for the purpose of selecting reliable measures of decision making in complex settings. These initial measures, and others added as a result of later research efforts, appear to be highly reliable and seem to reflect the entire range of decision styles determining the quantity and quality of performance. This section of the report will describe these measures, initially in general terms, followed by a section providing formulas (where applicable) for measurement.

1. Decision categories: These are the number of categories that are viewed as independent by the decision maker. In the military, this may be an infantry attack, calling in bombers, Naval shelling, etc. Comparisons based on the number of decision categories used are meaningful only if (a) the resources are constant across decision makers, and if (b) training or knowledge (familiarity with the setting) is equivalent. Decision

categories can be meaningfully measured in some simple and most complex tasks.

2. Spread across decision categories: Here we are concerned with the degree to which a decision maker favors specific decision categories and rarely uses other categories. Again, the measure can apply to both simple and complex tasks.

3. Number of decisions: The number of (independent) decisions made per unit time. In some simple tasks, the number of decisions may be replaced by the number of actions.

4. Number of integrations: The number of relationships between decisions in different decision categories where one decision is used as the basis for another. Number of forward integrations reflects relationships where a decision at an earlier point in time is made to allow (in strategic sequence) for the possibility of the later related decision. Number of backward integrations reflects relationships where a later decision is based on a previous decision, even though the previous decision had been made for an unrelated reason. This measure is more useful in complex multidimensional tasks. Equivalent use of strategy measurement can be developed for some simple tasks.

5. QIS (Quality of Integrated Strategies): This measure is sensitive to the length (over time) of complex strategic planning in complex tasks and to integration and to the complexity (interactive multiplicity) of the strategies carried out over time. A time frame measure can be developed for simple tasks as well, although it tends to show little equivalence to the QIS measure.

6. Number of respondent decisions: The number of decisions which are made in direct response to information received. A subcategory, number of retaliatory decisions, reflects respondent decisions that reflect a 1:1 orientation to the information received. In this case, there is no use of the respondent (here, retaliatory) decision in any overall strategy. This measure is equally useful in both simple and complex tasks.

7. Characteristic response and response speed to information: The degree to which information received results in more respondent or more differentiated/integrated decision making and the average time taken from receipt of information to the response. The measure is useful in both simple and complex tasks.

8. Quality (if immediate response is required): Situations and information inherent in situations differ in the degree to which immediate responding is needed or unnecessary if success is to be achieved. We are here concerned with a situation in which only immediate responding is likely to lead to success (response adequacy). The measure is relevant in both simple and complex tasks.

9. Quality (if novel strategy is required): Situations that are unpredictable and in rapid flux require reconsideration of previous established patterns and re-adaptation to the changed environment. We are here concerned with the degree to which a decision maker can adapt to rapid and unexpected modifications of the situation and can respond appropriately to obtain an adequate success level. The measure is relevant to complex tasks and may be relevant to some simple tasks.

10. Quality (if learned pre-established strategy is required): Situations containing many components and contingencies that are relatively stable and

allow a well-practiced, yet complex response pattern to a series of expected or familiar stimuli require the responses rated highly here. The measure is relevant to many complex tasks and may be relevant to some simple tasks.

Formulas

The following formulas reflect the decision processes and their measures as discussed above:

1. Decision categories:

$$\sum_{1}^{P} c$$

where, c is the number of categories employed

p is any period of time of interest (e.g., a playing period in the simulation during which some variable was manipulated at a specific level).

2. Spread across decision categories:

$$\sum_{1}^{P} 2\ (d_{Ca} - d_{Cb}) + (d_{Cd} - d_{Ce})$$

where, d is the number of decisions

d_{Ca} is the number of decisions from the category or categories representing the upper ten percent of decision frequency

d_{Cb} is the number of decisions from the category or categories representing the lowest ten percent of decision frequency

d_{Cd} is the number of decisions from the category or categories representing the remaining upper forty percent of decision frequency

d_{Ce} is the number of decisions from the category or categories representing the remaining lower forty percent of decision frequency.

3. Number of integrations:

$$\sum_{1}^{P} i_f \quad \text{or} \quad \sum_{1}^{P} (i_f + i_b)$$

where, i_f is the number of connections between decisions of one category with decisions of another category, reflecting pre-planning of the later decisions as the previous decisions is made as a (strategic) necessary antecedent to the later decision

i_b reflects the number of connections between a later decision of one category and an earlier decision of another category, where the outcome of the previous decision is used for the purpose of achieving the goals of the later decision, where the relationship between these decisions was, however, not planned when the earlier decision was made.

Which of the two integration measures is utilized (or whether both are utilized) should depend on the interest of the researcher or trainer/assesser; i.e., is strategic planning of interest or is general strategic behavior of interest.

4. Number of decisions:

$$\sum_{1}^{P} d$$

where, d is the number of decisions

5. QIS (Quality of Integrated Strategies):

$$\sum_{1}^{P} W\ (1 + n_p + n_f)$$

where, W represents the length of time dimension of any forward integration between the decision points connected by that integration

n_p is the number of other forward integrations connecting to the decision representing the beginning point of the integration in question

n_f is the number of other forward integrations connecting to the decision representing the endpoint of the integration in question.

The number of integrations, n_p and n_f, here includes <u>all</u> forward integrations linked to a relevant decision point in chain sequences via several decision points (i.e., the linked decision points are part of a continuing strategic decision sequence).

6. Number of respondent decisions:

$$\sum_{1}^{P} r$$

where, r is any decision made within a given time period (depending on the speed i.e., time compression, of the simulation) after the receipt of relevant information and made in direct response to that information.

7. Response speed :

$$\frac{\sum_{1}^{P} t_r}{r_p}$$

where, t_r is the elapsed time between information received and a subsequent respondent decision to that information, if such a response is made,

r_p is the number of respondent decisions made during the time period from 1 to P.

8. Quality (if immediate response is required):

Measured by external criteria, e.g., ratings by experts or superiors.

9. Quality (if novel strategy is required):

Measured by external criteria, e.g., ratings by experts or superiors.

10. Quality (if learned pre-established strategy is required):

Measured by external criteria, e.g., ratings by experts or superiors.

Predictions Based on Complexity Theory

The measures (and their formulas) described on the preceding pages should distinguish between persons (or homogeneous groups) who primarily employ one or another of those styles. Specific predictions relating the styles and the measurements can be based on the more recent developments of complexity theory (e.g., Streufert, 1978; Streufert and Streufert, 1978). The predictions are presented in Table 1.

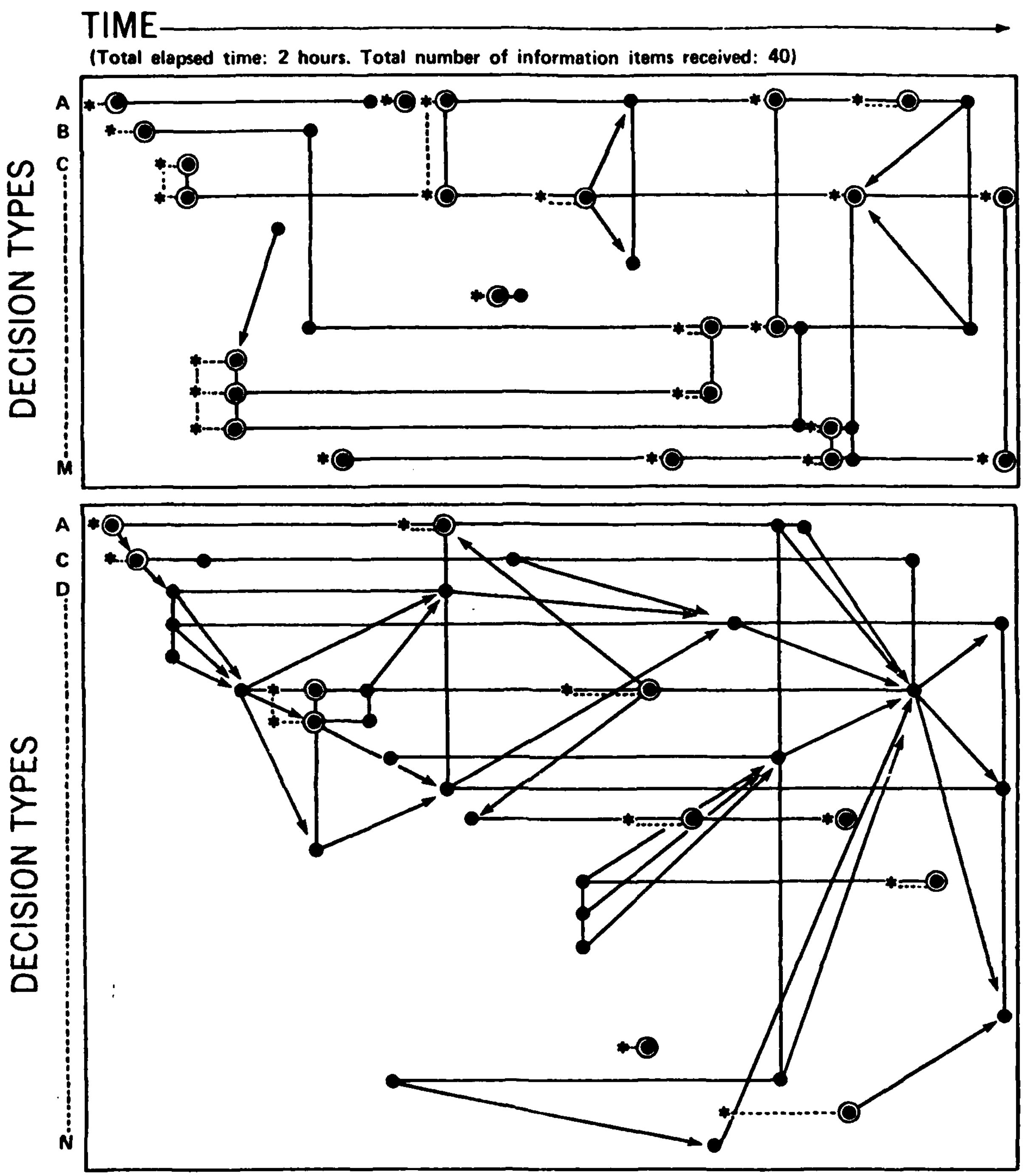
TABLE 1

STYLE USED IN DECISION MAKING	1 DECISION CATEGORIES	2 SPREAD ACROSS DECISION CATEGORIES	3 NUMBER OF DECISIONS	4 NUMBER OF INTEGRATORS	5 QIS	6 NUMBER OF RESPONDENT DECISIONS	7 RESPONSE TO INCOMING INFORMATION	8 QUALITY IF IMMEDIATE RESPONSE IS REQUIRED *	9 QUALITY IF NOVEL STRATEGY IS REQUIRED *	10 QUAL. IF LEARNED (PRE-ESTABLISHED) STRATEGY IS REQUIRED *
LOW UNI-DIMENSIONAL	FEW	MASSED IN FEW CATEGORIES	MATCHING INCOMING INFORMATION	NONE	VERY LOW	HIGH	RESPONDENT, RAPID	MODER. BUT MAY RESPOND INCORREC. IF RESPONSE ISN'T IN REPERTOIRE	LOW	LOW
UNI-DIMENSIONAL	FEW	MASSED IN CERTAIN GROUPINGS	MATCHING INCOMING INFORMATION	VERY FEW SHORT RANGE	VERY LOW	HIGH	RESPONDENT, RAPID	MODERATELY HIGH, MAY RESP. INCORR. OR INAPPROPRIATELY IF RESPONSE IS NOT IN REPERTOIRE	LOW	MODERATE
GENERAL DIFFEREN-TIATOR	MORE THAN ABOVE, SAME AS INTEGRATOR, SELF GENERATION, MORE EVEN SPREAD	MORE EVEN	AVERAGE	FEW SHORT-RANGE, FEW RESPONDENT DECISIONS ARE INTEGRATED	LOW	MODERATE	MODERATELY SLOW	MODERATELY HIGH TO HIGH	MODERATE	MODERATE
CLOSED HIERARCHICAL DIFFERENTIATOR	DEPENDS ON HIERARCHY	DEPENDS ON HIERARCHY	AVERAGE	VERY FEW, SOME PRE-DETERMINED RELATIONSHIPS	VERY LOW	MODERATELY HIGH	MODER. RAPID, POTENTIAL DISTORTION	HIGH	LOW	MODERATELY HIGH
EXCESSIVE DIFFEREN-TIATOR	MORE THAN ALL OTHERS	NO PREDICTION	FEW	VERY FEW SHORT RANGE	VERY LOW	MODERATELY LOW	SLOW	MODERATE (TOO SLOW)	LOW	MODERATELY LOW
LOW LEVEL INTEGRATOR (FLEXIBLE)	MODERATE	NO PREDICTION	AVERAGE, SOME EFFECT OF INFORMATION	HIGH SHORT-RANGE SOME RESPONDENT DECIS. INTEGRATED	LOW TO MODERATE	MODERATE	MODER. SPEED, MORE LIKELY INTEGRATED	MODERATELY LOW	MODERATELY HIGH	MODERATELY HIGH
HIGH LEVEL INTEGRATOR (FLEXIBLE)	MODERATE	MORE EVEN, DEPENDING ON STRAT. SEQUENCE GROUPINGS, MAY CHANGE WITH TIME	AVERAGE, LESS AFFECTED BY INFORMATION	HIGH-SHORT & LONG RANGE, MANY RESPONDENT DECIS-IONS INTEGRATED	HIGH	MODERATE	MODERATE SPEED, INTEGRATED OR RESPOND., DEPEND. ON PERCEIVED SITUATION DEMAND	LOW	HIGH	MODERATELY HIGH
HIERARCHICAL (CLOSED) INTEGRATOR	DEPENDS ON HIERARCHY	DEPENDS ON HIERARCHY	AVERAGE	MODERATELY HIGH, DEPENDS ON HIER. PRE-DETERMINED RELATIONSHIPS	HIGH PRE-DETERMINED RELATION-SHIPS	MODERATELY HIGH	MODER. RAPID, POTENTIAL DISTORTION	MODERATE	MODERATELY LOW	HIGH
NON-CLOSING INTEGRATOR	FEW, EXCEPT WHEN IN GROUPINGS	EVEN	LOW, EXCEPT IN GROUPINGS	FEW, BUT LONG-TIME RANGE AND CLUSTERS	MODERATE DUE TO VALUE OF W	LOW	DELAYED NON-RESPONDENT	LOW	LOW	LOW
MEASURE	$\sum_1^p n$	$\sum_1^p 2(d_{ca}-d_{cb})+(d_{cd}-d_{ce})$	$\sum_1^p d$	$\sum_1^p I_f$ OR $\sum_1^p (I_f+I_h)$	$\sum_1^p W(Im_p+m_f)$	$\sum_1^p r$	$\sum_1^p t_r / t_p$ (TIME ONLY)	JUDGMENT BY EXPERTS OR PARAMETER	JUDGMENT BY EXPERTS OR PARAMETER	JUDGMENT BY EXPERTS OR PARAMETER

*ASSUMING EQUIVALENT KNOWLEDGE, TRAINING, OTHER SKILLS, ETC.

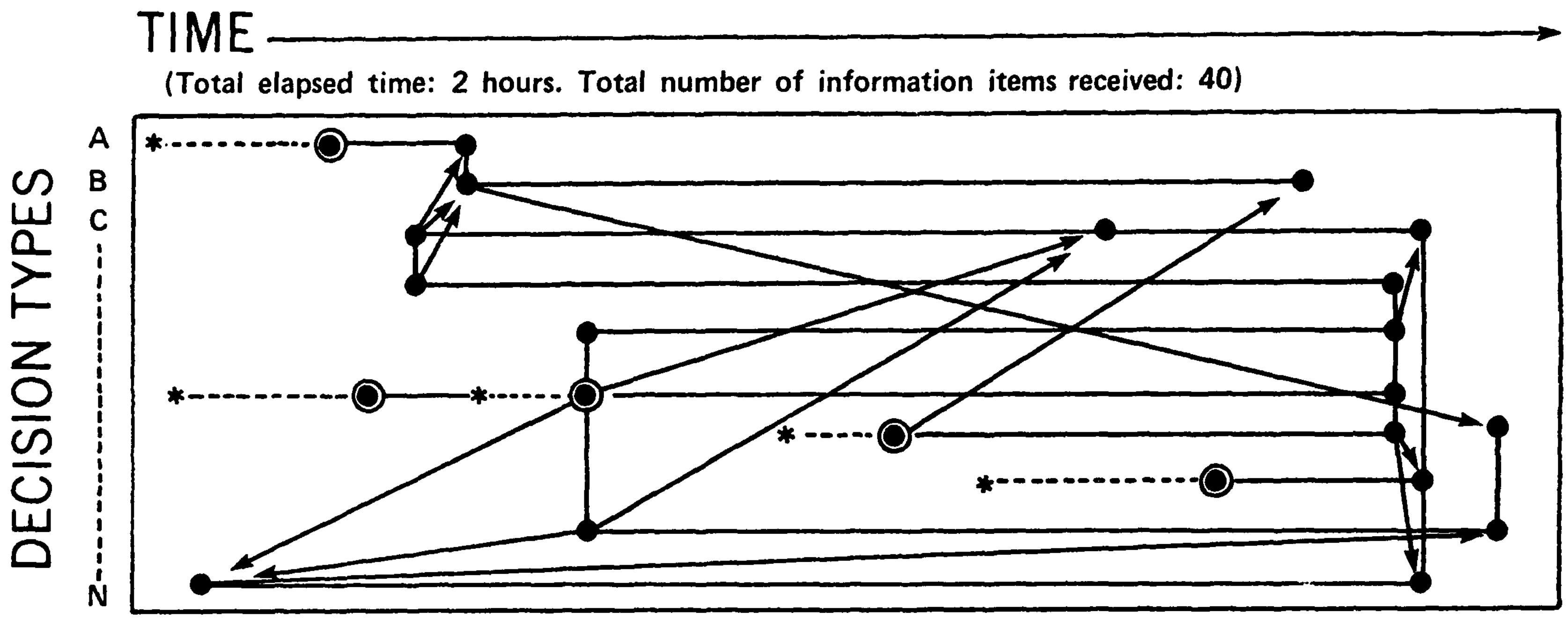
Examples of Decision Matrices

As an illustration of various decision making styles reflecting the vertical in the preceding table, several decision making plots from the TNG game are attached. Inspection of these plots (also labeled "decision matrices" in previously published research) will reveal the differences in the scores predicted above.



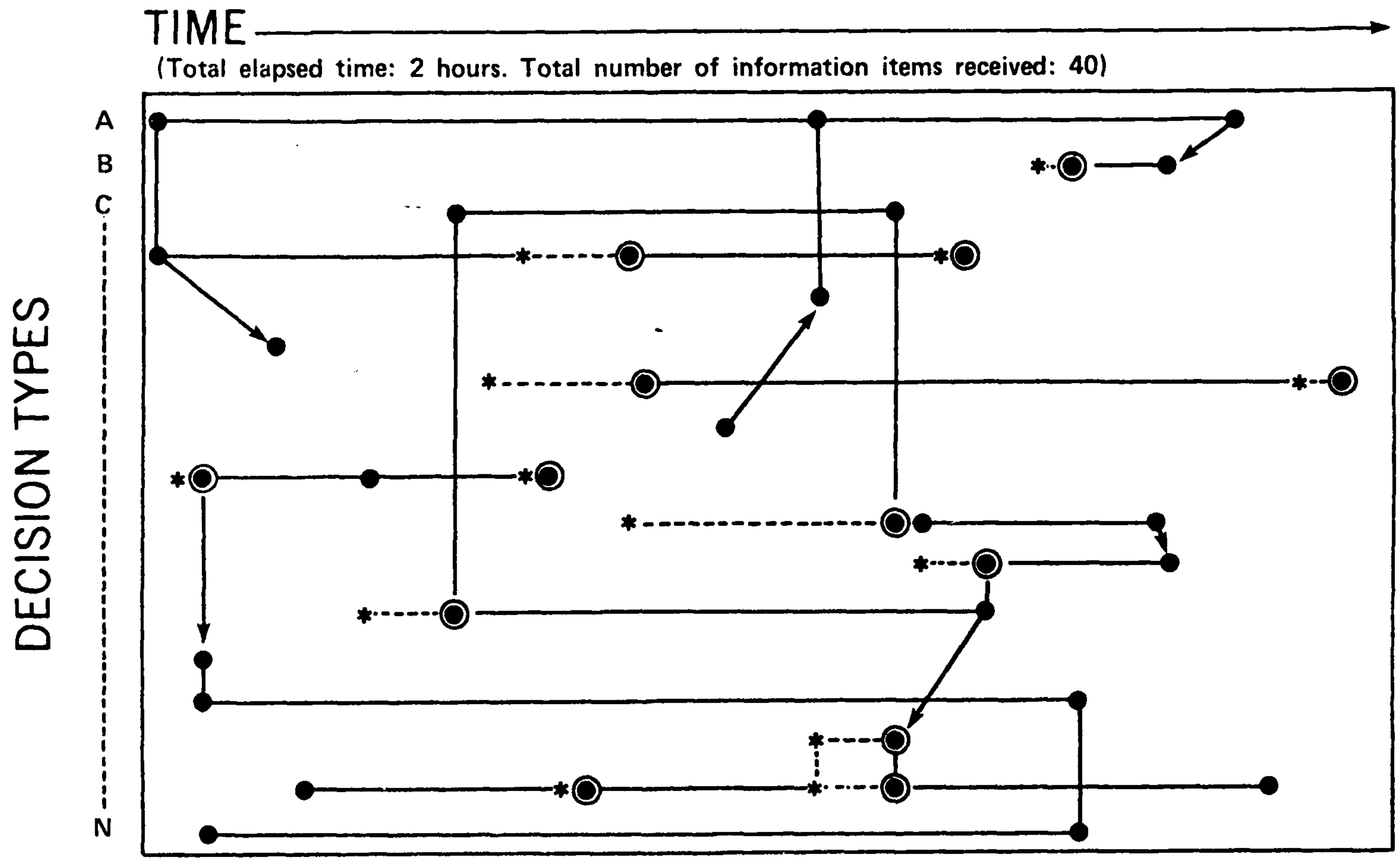
EACH POINT REPRESENTS A DECISION EXECUTED BY THE TEAM.
EACH VERTICAL LINE CONNECTS DECISIONS MADE AT THE SAME POINT IN TIME.
EACH HORIZONTAL LINE CONNECTS DECISIONS OF THE SAME TYPE MADE AT DIFFERENT POINTS IN TIME.
EACH DIAGONAL REPRESENTS THE STRATEGIC INTEGRATION OF DIFFERENT DECISIONS AT DIFFERENT POINTS IN TIME. DIAGONALS POINTING FORWARD REFLECT ADVANCE STRATEGIC PLANNING.
EACH CIRCLED DOT REPRESENTS A DECISION RESPONSE TO INFORMATION RECEIVED AT * THE DOTTED DISTANCE FROM * TO ● REFLECTS THE INFORMATION TO DECISION INTERVAL.
EACH DECISION TYPE REPRESENTS A SELF SELECTED DIFFERENTIATED DECISION CATEGORY BASED ON AVAILABLE RESOURCES.

Figure 2. Decision matrices produced as a result of normal unidimensional and high integrative decision making.



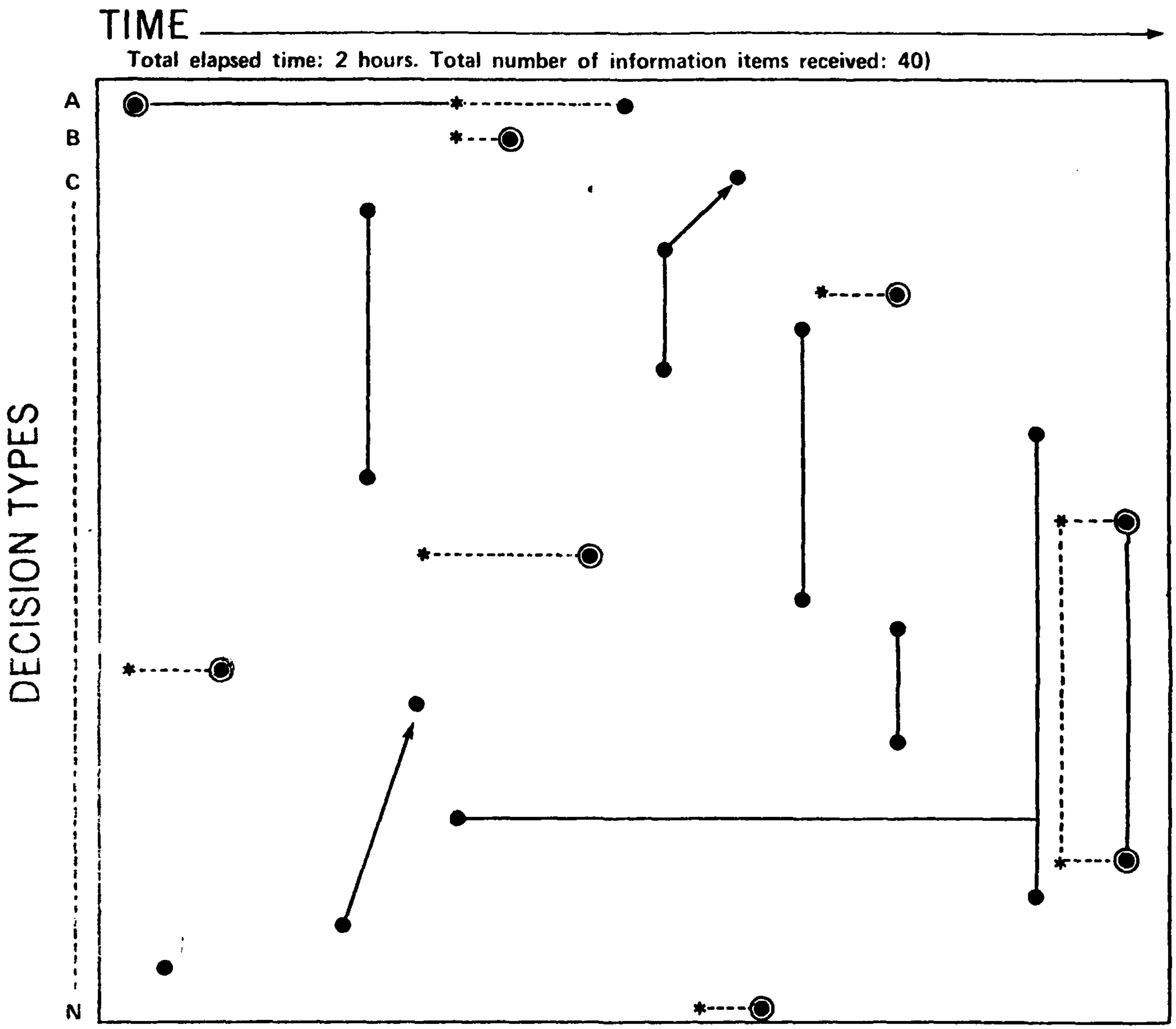
EACH POINT REPRESENTS A DECISION EXECUTED BY THE TEAM.
EACH VERTICAL LINE CONNECTS DECISIONS MADE AT THE SAME POINT IN TIME.
EACH HORIZONTAL LINE CONNECTS DECISIONS OF THE SAME TYPE MADE AT DIFFERENT POINTS IN TIME.
EACH DIAGONAL REPRESENTS THE STRATEGIC INTEGRATION OF DIFFERENT DECISIONS AT DIFFERENT POINTS IN TIME. DIAGONALS POINTING FORWARD REFLECT ADVANCE STRATEGIC PLANNING.
EACH CIRCLED DOT REPRESENTS A DECISION RESPONSE TO INFORMATION RECEIVED AT * THE DOTTED DISTANCE FROM * TO ◉ REFLECTS THE INFORMATION TO DECISION INTERVAL.
EACH DECISION TYPE REPRESENTS A SELF SELECTED DIFFERENTIATED DECISION CATEGORY BASED ON AVAILABLE RESOURCES.

Figure 3. Decision matrix produced as a result of low unidimensional decision making.



EACH POINT REPRESENTS A DECISION EXECUTED BY THE TEAM.
EACH VERTICAL LINE CONNECTS DECISIONS MADE AT THE SAME POINT IN TIME.
EACH HORIZONTAL LINE CONNECTS DECISIONS OF THE SAME TYPE MADE AT DIFFERENT POINTS IN TIME.
EACH DIAGONAL REPRESENTS THE STRATEGIC INTEGRATION OF DIFFERENT DECISIONS AT DIFFERENT POINTS IN TIME. DIAGONALS POINTING FORWARD REFLECT ADVANCE STRATEGIC PLANNING.
EACH CIRCLED DOT REPRESENTS A DECISION RESPONSE TO INFORMATION RECEIVED AT * THE DOTTED DISTANCE FROM * TO ◉ REFLECTS THE INFORMATION TO DECISION INTERVAL.
EACH DECISION TYPE REPRESENTS A SELF SELECTED DIFFERENTIATED DECISION CATEGORY BASED ON AVAILABLE RESOURCES.

Figure 4. Decision matrix produced as a result of general differentiative decision making.



EACH POINT REPRESENTS A DECISION EXECUTED BY THE TEAM.
EACH VERTICAL LINE CONNECTS DECISIONS MADE AT THE SAME POINT IN TIME.
EACH HORIZONTAL LINE CONNECTS DECISIONS OF THE SAME TYPE MADE AT DIFFERENT POINTS IN TIME.
EACH DIAGONAL REPRESENTS THE STRATEGIC INTEGRATION OF DIFFERENT DECISIONS AT DIFFERENT POINTS IN TIME. DIAGONALS POINTING FORWARD REFLECT ADVANCE STRATEGIC PLANNING.
EACH CIRCLED DOT REPRESENTS A DECISION RESPONSE TO INFORMATION RECEIVED AT * THE DOTTED DISTANCE FROM * TO ◉ REFLECTS THE INFORMATION TO DECISION INTERVAL.
EACH DECISION TYPE REPRESENTS A SELF SELECTED DIFFERENTIATED DECISION CATEGORY BASED ON AVAILABLE RESOURCES.

Figure 5. Decision matrix produced as a result of excessive differentiative decision making.

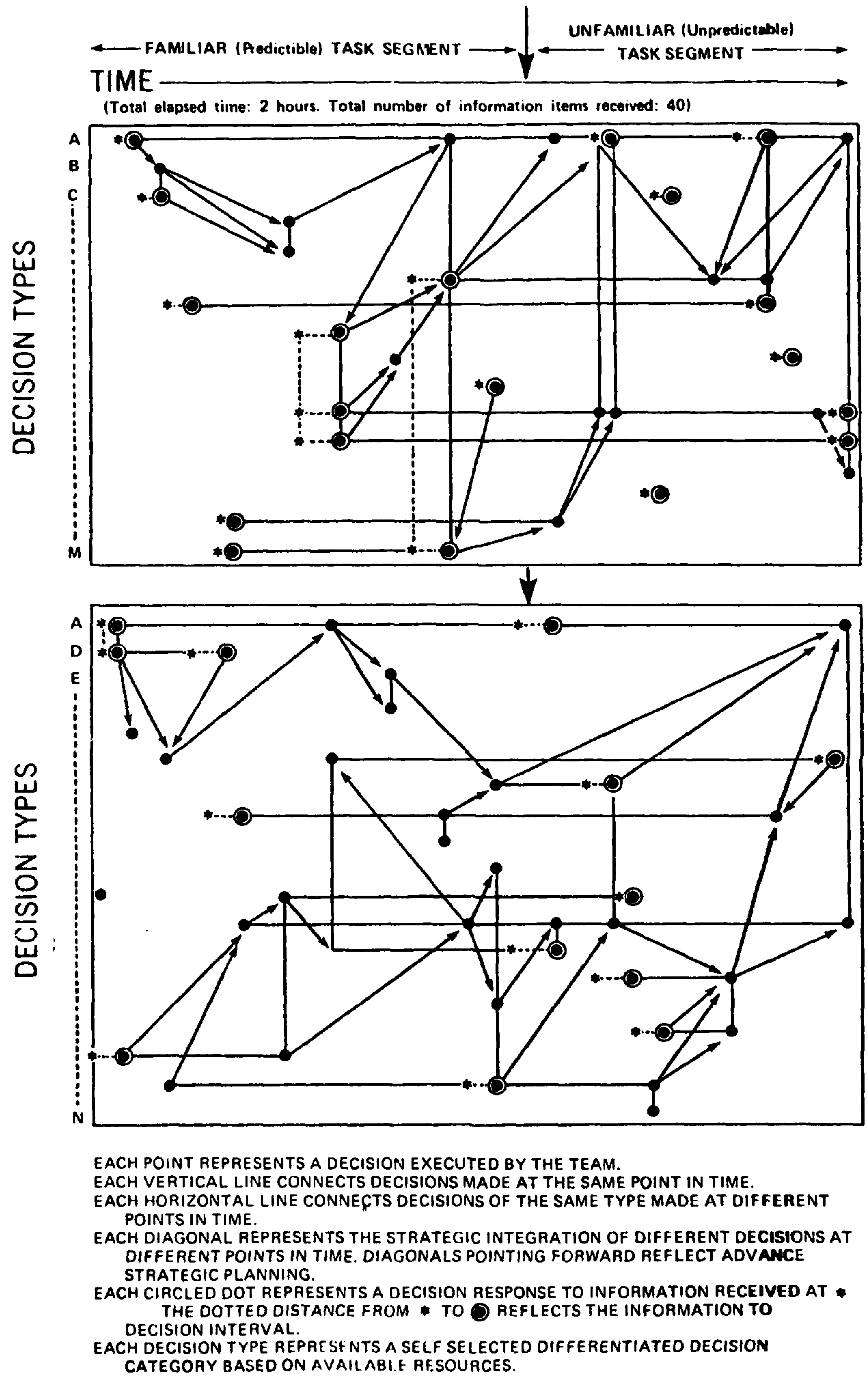


Figure 6. A comparison of decision matrices produced as a result of hierarchical integrative and flexible integrative decision making during a familiar and an unfamiliar task segment.

Reliability/Validity Information about the Measures

Measurement for number of decisions, number of respondent decisions, number of integrations, QIS, and number of decision categories (also listed as number of differentiations in previous publications) has been employed frequently in previous research. Research efforts have varied from laboratory simulations focused on theoretically oriented data to measurement in organizational settings. Reliability and validity statements presented here are drawn from both published and unpublished data obtained by Streufert and associates (c.f., Streufert and Streufert, 1978) in various research projects sponsored by, among other organizations, ONR, OE, BMV, BRS and BBR. All measures have shown high levels of reliability in theoretical as well as applied research. Validity data are available for QIS and number of integrations, indicating that higher levels of managers score higher on these measures of integration. Further, number of decisions has been shown to vary directly (to an asymptotic level) with quantity of information (load). Overload and underload (information deprivation) have been shown to depress both number of integrations and decision categories. More severe depression of information load and information deprivation has severely decreased QIS. It has been demonstrated that the number of respondent decisions rises slowly as information load changes from deprivation to optimal levels, with a change to a sharp rise as overload begins to depress integrative performance.

Individual differences and (homogeneous) group differences among decision makers varying in level of cognitive complexity (differentiative and/or integrative style) have been demonstrated in experimental and applied settings. Persons with higher integrative or QIS scores tend to reach higher organizational positions or often gain greater levels of responsibility within a given position.

Information pertaining to reliability and validity of the other measures listed above, as they relate to different styles of cognitive functioning in experimental and applied organizational settings, will be collected, in part, under the present contract.

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